

REMARKS

Claims 15 and 35 are amended. Claims 15-22 and 35-41 are pending in the application.

Claims 15-22 and 35-41 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over a combination of Mathews (U.S. Patent 5,658,829); and either Allen (U.S. Patent No. 5,970,373); or Donohoe (U.S. Patent No. 6,093,655); or over the combination of Mathews and Donohoe or Allen in further view of one or more of Sharan (U.S. Patent No. 5,747,166); Brown (U.S. Patent No. 5,780,359); and Nagashima (U.S. Patent No. 5,129,958). The Examiner is reminded by direction to MPEP § 2143 that a proper obviousness rejection has the following three requirements: 1) there must be some suggestion or motivation to modify or combine reference teachings; 2) there must be a reasonable expectation of success; and 3) the combined references must teach or suggest all of the claim limitations. Each of these three factors must be shown in order to establish a *prima facie* case of obviousness, the burden of which is upon the Examiner. Claims 15-22 and 35-41 are allowable over the various cited combinations of Mathew, Allen, Donohoe, Sharan, Brown and Nagashima for at least the reasons that the references, individually or in combination, fail to disclose or suggest each and every element in any of those claims, fail to provide motivation and fail to provide a basis for a reasonable expectation of success.

Independent claim 15 recites a plasma etching process where a plasma is generated from a gas having active components consisting of one or more of O₂, O₃, H₂, and NH₃. Claim 15 specifically recites that the plasma is oxygen-comprising and is utilized to remove a residue from an outwardly exposed conductive silicon-comprising material at a

base of an opening. Mathews discloses removal of a resist material using O₂ etching followed by a dry physical argon etch to produce a faceted sidewall at an upper surface of an opening (col. 3, ll. 43-64). As set forth in the applicant's previous response, such disclosure does not teach or suggest the claim 15 recited removal of a residue from an outwardly exposed conductive silicon-comprising material at the base of an opening, or the recited removal of such material utilizing plasma generated from a gas having active components consisting of one or more of O₂, O₃, H₂ and NH₃.

With respect to such previous argument the Examiner indicates at page 2 of the present Action that the previous rejection is maintained because "it is true that Mathews et al. do not explicitly teach utilization of an oxygen plasma to remove residue from the exposed conductive silicon-comprising material (silicon substrate includes a dopant diffusion/active region, 14,38 in coll 1, lines 25-26 and col. 3, lines 24-25) but this limitation would have been obvious during the oxygen etching of the masking layer because the active region is exposed to the oxygen plasma and expected to remove the remaining residue upon an over etching of the masking layer". Applicant notes that the "over etching of the masking layer" set forth by the Examiner is entirely unsupported by the cited reference. In fact, Mathews specifically indicates that oxygen etch is conducted to strip the resist and pull it away from the edge of the contact "and not to necessarily fully strip the resist". Accordingly, the use of an oxygen etch to remove resist as disclosed by Mathews does not teach or suggest over etching of the masking layer as proposed by the Examiner or the claim 15 recited utilizing an oxygen-comprising plasma to remove a residue from the outwardly exposed conductive silicon-comprising material.

At page 3 of the present action the Examiner indicates that the physical argon etch disclosed by Mathews is a subsequent additional step which may provide a cleaner contact area and that “the present claim is not limited that the residue removal step is a single step process”. For clarification purposes, applicant has amended independent claim 15 to indicate that the utilizing the oxygen-comprising plasma for removal of a residue is subsequent to and independent of removing the masking layer and recite that the oxygen comprising plasma is utilized to entirely remove residue from the outwardly exposed conductive silicon-comprising material. The Examiner further indicates that “transposition of process steps or the splitting of one step into two, where the processes are substantially identical or equivalent in terms of function, manner and result, was held to be not patentably distinguish the processes”. Applicant notes that the Examiner has not provided any basis in the prior art or any other evidence supporting the contention of “substantially identical or equivalent in terms of function, manner and result”. Rejection based upon such grounds is therefore unfounded.

As additionally set forth in applicant’s previous response, Allen does not teach or suggest removal of residue from an outwardly exposed conductive silicon-comprising material. Such failing is acknowledged by the Examiner at page 3 of the present Action. However, the Examiner indicates that Mathews teaches etching material to form an opening to outwardly exposed silicon-comprising material and “obviously leaving residue on all the exposed surfaces”. The Examiner indicates at page 7 of the present Action that this contention is based upon the Examiner’s belief that since the active region is exposed to oxygen plasma in the Mathews disclosure, oxygen plasma is expected to remove the remaining residue upon over etching. As indicated above this “over etching” process is not

supported by the Mathews disclosure. Additionally, there is no basis in the Mathew's reference for the Examiner's statement "obviously leaving residue on all the exposed surfaces", and no other basis has been set forth in the Action. Accordingly, in addition to failing to disclose or suggest each and every element, the Mathews disclosure does not provide any basis for an expectation of successfully removing residue from an outwardly exposed conductive silicon-comprising material or provide motivation for the recited removal.

As acknowledged by the Examiner, Allen does not contribute toward suggesting removal of residue from an exposed conductive silicon-comprising material. The combination of Allen and Mathews therefore fails to disclose each and every element in claim 15. Further, the Allen disclosure of removal of a polymer material 44 from a surface of a nitride material 38 (Figs. 7-8 and the accompanying text at col. 5, ll. 53-67) does not contribute toward providing a basis for a reasonable expectation of achieving the claim 15 recited entirely removing a residue from an outwardly exposed conductive silicon-comprising material utilizing an oxygen comprising plasma. Since Allen does not disclose or suggest the recited residue from an outwardly exposed conductive silicon-comprising material, the combination of Allen and Mathews cannot provide motivation for such removal as recited in claim 15. Accordingly, the combination of Allen and Mathews fails to provide a basis for a reasonable expectation of success, fails to provide motivation for the combination, and fails to teach or suggest each and every element in claim 15.

At page 4 of the present action the Examiner indicates continued reliance upon the Donohoe reference because applicant's previous indication that such was unavailable as a basis for a 103 rejection was not sufficiently clearly and conspicuously set apart in the

previous response. Accordingly, applicant presents the following statement.

STATEMENT OF COMMON OWNERSHIP

Applicant hereby states that the present application and U.S. Patent No. 6,093,655 issued to Donohoe were commonly owned by Micron Technology, Inc. at the time the invention of the present application was made. The Donohoe patent qualifies as prior art only under 35 U.S.C. § 102(e). Accordingly, as set forth in 35 U.S.C. § 103(c) the Donohoe patent is unavailable as a basis for any obviousness rejection of the currently pending claims.

The Examiner indicates reliance upon as Sharan as disclosing exposing monocrystalline silicon and removal of an unwanted material utilizing hydrogen plasma. However, the hydrogen plasma disclosed by Sharan does not teach, suggest or contribute toward suggesting the oxygen-comprising plasma recited in claim 15 or utilization of such plasma for removing residual material in an independent step relative to removing photoresist. Accordingly, the combination of Mathews, Allen and Sharan does not disclose or suggest each and every element recited in claim 15. Further, the utilization of a H₂ plasma as disclosed in Sharan does not contribute toward providing a reasonable expectation of achieving the claim 15 recited removal of residue utilizing the recited oxygen-comprising plasma.

As further indicated in the present Action, Brown is relied upon as disclosing various processing temperatures and Nagashima is relied upon as disclosing utilization of NH₃ and hydrogen as a reducing gas. However, the temperatures disclosed by Brown and the

utilization of NH_3 and hydrogen as reducing agents as disclosed by Nagashima does not contribute toward suggesting the claim 15 recited use of an oxygen comprising plasma generated plasma generated from one or more of O_2 , O_3 , H_2 and NH_3 , or the use of such plasma for removing residue from the base of an opening where the base comprises an outwardly exposed conductive silicon-comprising material. Nor does Brown or Nagashima contribute to providing a basis for a reasonable expectation of success, or motivation for combination. Not one of the three factors required to be shown to establish a *prima facie* case of obviousness has been met. Accordingly, a *prima facie* case of obviousness has not been established with respect to independent claim 15 and such is allowable over the art of record.

As amended, independent claim 35 recites plasma etching utilizing a plasma generated from a gas having active components consisting of one or more O_2 , O_3 , H_2 and NH_3 where the etching is independent of removing of the photoresist layer and entirely removes carbon containing polymer residue from monocrystalline silicon substrate material. Independent claim 35 is allowable over the various cited combinations of Mathews, Allen, Donohoe, Sharan and Brown and Nagashima for at least reasons similar to those discussed above with respect to independent claim 15.

Dependent claims 16-22 and 36-41 are allowable over the various cited combinations of Mathews, Allen, Donohoe, Sharan, Brown and Nagashima for at least the reason that they depend from corresponding allowable base claims 15 and 35.

For the reasons discussed above, pending claims 15-22 and 35-41 are allowable. Accordingly, applicant respectfully requests formal allowance of such pending claims in the Examiner's next action.

Respectfully submitted,

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